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Abstract

A remarkable degree of self-sufficiency is a distinguishing feature of the typical Third World family farm. However, many family farms deviate from this pattern and engage in transactions involving land and labor. The question is why some households use land and labor markets while others do not. We posit that markets may function imperfectly and discourage households from participation. We model imperfections in terms of transaction costs which drive a household-specific wedge between sales and purchase prices of factors. When the shadow price of a factor falls inside this range, the household has no incentive to adjust that particular margin. The frictionless model emerges as a limiting case in which sales, purchase and shadow prices are equal. The empirical work is based on data from a 1973 nationwide survey in Turkey. The subsample of owner-cultivators is sorted into a 3×3 table according to the adjustments that took place on the land margin (lease out, do not participate, lease in), and the labor margin (hire out, do not participate, hire in), and the determinants of the observed pattern of adjustments are investigated. The estimating equations are obtained from the theoretical model by treating the shadow, sales, and purchase prices as latent variables and expressing them as linear functions of observables. We use an unrestricted bivariate ordered probit specification and estimate the parameters using maximum likelihood methods. This procedure uncovers the links between observables and the transaction costs faced by each household, making it possible to confront transactions cost theory with real world data.

ملخص

تعد الدرجة العالية من الاكتفاء الذاتي أحد السمات البارزة للمزرعة العائلية في العالم الثالث. غير أن العديد من المزارع العائلية تنحرف عن هذا النموذج وتشارك في معاملات يدخل ضمنها الأرض والعمل. والسؤال المطروح في هذا المضمار هو: لماذا تلجأ بعض الأسر إلى أسواق الأرض والعمل بينما لا يستغلها البعض الآخر؟ ونفترض هنا أن الأسواق قد لا تعمل بشكل كامل، الأمر الذي لا يشجع الأسر على المشاركة. ونضع نموذجاً لعدم الكمال فيما يتعلق بتكاليف المعاملات التي تضع للأسرة هامشاً محدّداً بين المبيعات وأسعار شراء عناصر الانتاج. وعندما يقع سعر الظل للعناصر في هذا النطاق لا يكون لدى الأسرة الحافز الكافي لتعديل هذا الهامش المحدّد. ويعتبر نموذج عدم الاحتكاك حالة محدّدة تتساوى فيها المبيعات والمشتريات وأسعار الظل. ويستند الجزء التطبيقي إلى بيانات من مسح قومي أجري في تركيا عام ١٩٧٣. وقد تم تقسيم عينة فرعية من الملاك/ المزارعين في جدول مكون من ٣×٣ وفقاً للتعديلات التي تمت على حدود الأرض (مؤجرون - لا يشاركون - مستأجرون) وحد العمل (عاملون لدى الآخرين - لا يشاركون - يستأجرون العمال)، كما يتم بحث محددات نمط التعديلات تحت الدراسة. وقد تم الحصول على المعادلات المقدرة من النموذج النظري عن طريق معاملة أسعار الظل والمبيعات والمشتريات كمتغيرات كامنة والتعبير عنها كدوال خطية للمتغيرات المدروسة. ونستخدم معادلة بروبيت ثنائية المتغير غير المحددة (unrestricted bivariate ordered probit equation) كما نقدر المؤشرات باستخدام منهج الامكان الأعظم. وتكشف هذه العملية عن الروابط بين المتغيرات الظاهرة وتكاليف المعاملات التي تتحملها كل الأسر مما يمكنهم من مواجهة نظرية تكلفة المعاملات ببيانات حقيقية.

1. INTRODUCTION:

Third World agriculture has provided neoclassical economists with fertile soil for sowing theories of incomplete and imperfect markets. During the past decade or so, it has been postulated that certain markets -- such as markets for land, hired labor and draft animals, insurance and credit markets, even product markets -- are outright missing, or at best, function imperfectly. Asymmetries of information and problems of moral hazard have been identified as the primary reasons behind market failure. The insights gleaned from the new models have resulted in dramatic shifts in views on agrarian institutions and policy prescriptions.[1]

When confronted with the evidence, a paradigm built on the premise that certain markets are missing quickly runs into empirical difficulties, just as one which postulates the existence of a complete set of markets for all inputs and products. In fact, many of the markets identified as missing in theoretical models do exist, but are not utilized by all agents. The empirically relevant question, then, is not whether or not markets exist, but why market participation is not universal.

Our paper is concerned with a particular context in which the general issues we have identified have been vigorously debated: the literature on the family farm. The self-sufficiency and resilience of the family farm, despite significant increases in commercial orientation in the product market, have posed serious challenges for neoclassical economists. Once viewed as backward and inefficient, the family farm has come to be identified as an optimal operational unit because of its ability to circumvent the incentive problems that organizations face, and to adjust to a diverse production environment in which limited scale economies are present.[2] While a remarkable degree of self-sufficiency is indeed a distinguishing feature of the typical family farm, transactions involving land and/or labor are not uncommon. Short-term transfer of use-rights to land (in the form of sharecropping or fixed-rent tenancy) as well as contracts for casual and permanent labor are observed in diverse agricultural environments. An important question that arises naturally is why some households use land and labor markets while others do not.

To confront the challenge, we adopt the approach that markets may function in a fashion that discourages certain households from participation. Our theoretical framework is based on the transaction costs formulation of de Janvry, Fafchamps and Sadoulet (1991) in which market imperfections drive a household-specific wedge between sales, and purchase prices of factors. When the shadow price of a factor falls inside this range, the household has no incentive to adjust along that particular margin.[3] The perfectly functioning market model emerges as a limiting

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[1] See the collections by Binswanger and Rosenzweig (1984), Singh *et al.* (1986), Bardhan (1989), and review articles such as Bell (1991), Hoff (1991), Otsuka *et al.* (1992).

[2] See Otsuka *et al.* (1992). Based on the 1970 World Census of Agriculture, Otsuka *et al.* report that 80 percent of farms and 60 percent of farmland around the world are under cultivation by the land owner. The only exception to the general pattern comes from the African continent, where communal ownership dominates (Table 1).

[3] This characterization is also used by Seavey (1987). Seavey does not write down

case as transaction costs are driven to zero, so that sales, purchase and shadow prices are equal. To obtain the estimating equations we treat the shadow prices, as well as the sales and purchase prices, as latent variables and express them as linear functions of observables. We use an unrestricted bivariate ordered probit specification and estimate the parameters using Maximum Likelihood methods. This procedure uncovers the links between the observables and the widths of the price bands, and quantifies the transaction costs faced by each household (up to a scale parameter).

The idea that transactions are costly, and might limit market participation is not new (see Datta and Nugent, 1989). Transaction cost formulations have been used by Bell and Sussangkarn (1988), Pereira and Sumner (1990), Shaban (1993), and Skoufias (1995) for analyzing land leasing decisions, by Lopez (1986) and Skoufias (1994) for studying adjustments to the labor margin, and by Seavey (1987) for studying adjustments to both margins.[4] What distinguishes our methodology is the direct connection we establish between transaction costs theory and its application, facilitated by a novel econometric formulation. Our model nests the entire continuum from the extreme situation of missing markets, to the extreme situation of perfectly functioning markets and offers a suitable framework for testing hypotheses motivated by the theoretical debates.

Notable in this regard is our ability to examine the adjustments to the land and labor margins jointly. Despite an abundance of theoretical models that underscore the interdependent nature of the adjustments that take place along various margins, the bulk of the empirical evidence comes from studies of individual margins. In their recent review, Otsuka, Chuma and Hayami (1992) underscore this point and contend that "...separate analyses of land and labor contracts have resulted in theoretical confusion as well as questionable interpretations of empirical data." We remedy this shortcoming and shed light on the issue of what can, and what cannot be claimed using partial models which focus on a single margin.

The remainder of the paper is organized as follows: in section 2 we examine the observed patterns of factor adjustment in our data set and establish the shortcomings of the approaches that posit perfectly functioning markets on the one extreme, and missing markets on the other. We present a theoretical model which subsumes both extremes in section 3, and characterize the equilibrium for a given family farm. In section 4 we operationalize the theoretical model, discuss the identification problems and derive the likelihood function. The hypotheses motivated by our reading of the literature are formalized in section 5. Description of the data and the empirical setting constitutes the subject of section 6. We present the estimation results and test the hypotheses in section 7. In the final section we take stock of what has been achieved.

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an explicit model but nevertheless provides an extremely thorough theoretical discussion. We benefited immensely from reading her dissertation, which was brought to our attention during the 1994 NEUDC Conference at Yale University.

[4] Benjamin (1992) and Jacoby (1993) discuss models in which efficiency differences induce the off-farm wage for family labor to be different from the cost of hiring others' labor. However they do not invoke a transaction costs interpretation. Pant (1983) and Nabi (1985) test hypotheses motivated by transaction cost formulations but do not model non-participation formally.

2. OBSERVED PATTERNS OF OWNER-CULTIVATION:

Consider the data presented in Table 1, which is based on a nationwide survey conducted in Turkey in 1973. In that table we subdivided our sample of 1015 land owners who self-cultivate (henceforth owner-cultivators) according to the adjustments that took place during the last growing season on the land margin (lease out, do not participate, lease in, simultaneously lease in and out), and on the labor margin (hire out, do not participate, hire in, simultaneously hire in and out).[5] We first focus on the figures printed in bold.

About 43 percent of the households in the sample refrain from making any factor adjustments during the growing season; they cultivate using their existing resources and do not market any portion of their land and labor endowments. Approximately 14 percent of the households adjust the land margin only, while 30 percent adjust the labor margin only. The remaining 13 percent of the households adjust both margins. Clearly, markets for short-term transactions do exist -- a majority of the owner-cultivators turn to markets and adjust land/labor ratios.

What do we make of the sizable proportion of households who do not adjust either margin? One possibility is that these households already have the desired factor ratios, which they may have attained by altering their endowments of land and labor over a period of time. Our data set provides some useful clues about the likelihood of this explanation. The figures entered in the cells of Table 1 in italics show the (conditional) distribution of households who had at least one member migrate over the five year period 1968-73. The third set of figures shows the (conditional) distribution of households who either bought or sold land over the ten year period 1963-73.[6] If households refrain from making short-run factor adjustments because they have made long-term adjustments, we would expect to find these (conditional) joint distributions concentrated in the $(a_h = 0, a_d = 0)$ cell, or at least the marginal distributions concentrated in the $(a_h = 0)$ or $(a_d = 0)$ cells. Evidently this is not the case.[7]

A widely accepted conjecture in the literature is that tenancy arises in response to imperfections in land or labor markets. One version of this conjecture builds on the widely observed pattern that land sales rarely take place

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[5] The labor margin can be adjusted for the entire growing season (permanent labor) or for part of it (seasonal or casual labor). To avoid problems associated with too many small (even zero) cell sizes, we do not distinguish between the two.

[6] The time intervals for long-run adjustment were dictated by data constraints. All permanent moves past the village boundary were considered as migrations.

[7] Based on the data presented on the margins of Table 1, the hypothesis of independence of the long-run (LR) regimes (adjust/do not adjust) and the short-run (SR) regimes (adjust down/do not adjust/adjust up) could not be rejected. Chi-squared tests of pairwise independence yielded the following p-values:

	SR-Labor	SR-Land
LR-Labor	.879	.102
LR-Land	.495	.854

Results from additional tests are reported in section 7.

(Binswanger and Rosenzweig, 1984). It suggests that tenancy can function as a substitute mechanism for attaining efficiency when land distribution cannot be altered otherwise.[8] A second justifies tenancy on the premise that moral hazard problems associated with hired labor or constraints on labor supply (demand) during slack (peak) seasons (Bardhan, 1984, Ch.7; Bell and Sussangkarn, 1988; Pereira and Sumner, 1991). This version may be termed the spillover hypothesis, in that inability to adjust on one margin renders adjustment on another more likely.

The independence of the short- and long-run adjustment patterns on the land margin in Table 1 calls the validity of the substitution explanation into question. The conditional adjustment probabilities shown in Table 2 reveal that the data also reject the spillover hypothesis. Given that the household has not adjusted the land margin ($a_d = 0$), we find that it is more likely *not* to adjust the labor margin. Given that the household has not adjusted the labor margin ($a_h = 0$), we see that it is much more likely *not* to adjust the land margin.

To recapitulate, neither a standard factor adjustment model which assumes perfectly functioning markets, nor models which place the burden of adjustment on one market because of imperfections in another, explain the observed patterns in the case of Turkey. It is, of course, conceivable that both explanations are partial truths, in that each applies to a particular segment of the sample. What is needed is a model which explains why certain households engage in market transactions, while others do not (or cannot), in an internally consistent fashion.

3. A THEORY OF MARKET PARTICIPATION:

Consider an agricultural household which can produce a single commodity using three inputs: land, labor and farming expertise. The first two are assumed to be tradable, while the last one is assumed to be non-tradable. The production function is assumed to have the usual properties.[9] In addition, marginal products of land and labor are assumed to be increasing functions of farming expertise. In this three-input model, whether the tradable input margins need to be altered (and in which direction) depends not only on the land/labor ratio and the relative prices of land and labor, but also on the amount of the non-tradable input the household has. If a household has abundant farming expertise, the shadow prices of land and/or labor are high; the household would like to hire in additional units of the scarce inputs and spread out its expertise.

Whether a household actually alters input margins depends on the costs of making the adjustment -- that is, on the costs of transacting with other agents. Following Bardhan (1989b) and Datta and Nugent (1989), we define transaction costs very broadly, to include the costs of information, negotiation, monitoring, coordination, and enforcement of contracts. In the spirit of de Janvry *et al.* (1991), we allow for the possibility that rental prices of land and labor, adjusted for the costs of transacting, may be different depending on whether the

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[8] Binswanger and Rosenzweig are careful to indicate that the absence of a sales market for land is *not* sufficient to usher in tenancy (1984, p.15). Elsewehere they point out that distress sales of land are likely to worsen landholding inequality and, can therefore exacerbate the use of tenancy (1986, p.527).

[9] Letting $q(d,h; f)$ denote the production function with d = land, h = labor, f = farming expertise, we assume $q_d > 0$, $q_h > 0$, $q_{dd} < 0$, $q_{hh} < 0$, $q_{dh} > 0$.

household is on the demand or supply side of the market. In the case of labor, search and commuting costs may reduce the effective wage a household member can earn by working off the farm. Recruitment and supervision costs may in turn increase the effective wage of a worker hired by the household.[10] In the case of land, the effective rental price of land leased out to a tenant may be lower because the tenant is likely to avoid the necessary measures for preserving land quality, maintaining the farm roads and the irrigation ditches, unless he is monitored.[11] When land is leased in, set-up costs may have to be incurred before it is engaged in production. For example, if own and leased land are in different locations, transportation costs have to be taken into consideration. If a sharecropping contract is adopted, costs of enforcement have to be figured in, so that input costs and the output are shared according to contract stipulations.[12]

There are other costs or constraints which may hinder the household from increasing its operation size. For example, available land area might not equal area needed. At times working capital constraints could exclude households from participation.[13] Finally, household-specific price differences may also emerge because of differences in attitudes towards risk. In short, transactions are costly, and may be influenced by a horde of exogenous and endogenous factors. This results in differences between the market price of a factor and its effective value to the prospective traders.

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[10] Transaction costs are especially high in the seasonal labor market where workers often move from one area to the other, and from one employer to another. In Turkey seasonal agricultural workers are often recruited through a middleman, termed *elçi* (messenger). The middleman contracts with fellow villagers for a specified duration. In family farms supervisory tasks are usually carried out by family workers, who spend all, or part of their time organizing and monitoring the activities of the hired workers. If workers are hired through a middleman, he also keeps an eye on the workers. The implicit threat of losing future contracts helps alleviate the incentive problems.

[11] Binswanger and Rosenzweig (1986, pp.517-8) argue that these costs are minimal because damage is easily visible, and maintenance requirements are low (except when trees and other perennials are present). Allen and Lueck (1992a) analyze farmland leases in the Midwestern region of the United States and conclude that factors such as information about the reputations of the members of the agricultural community, preference for long term relationships, and mutual respect for common law mitigate the need for complicated contracts. Aksoy (1984, p.89), however, offers evidence that the concerns mentioned in the text are entertained by Turkish landowners, who may exercise their traditional right to examine the leased property, and even check on the farm operations.

[12] In their examination of agricultural contracts used in Midwestern United States, Allen and Lueck (1992b, p.402) report that the costs of measuring and dividing the output, and adjusting for quality differences are important features that distinguish share contracts. Aksoy (1986, p.89) underscores similar concerns and cites a Turkish proverb: "he who does not leave his footmarks in the field closes his eyes during harvest time."

[13] Put differently, access to capital markets may be unequal. The literature identifies land as the most important form of collateral (Binswanger and Rosenzweig, 1986; Eswaran and Kotwal, 1986). Empirical evidence from Turkey indicates that the amount of credit that can be raised is proportional to the amount of land owned (Ministry of Agriculture, 1967).

Define p as the market price of a factor, and let $\tilde{p}^-$ and $\tilde{p}^+$ respectively denote the effective price of a factor when it is sold (–), and when it is purchased (+). Here and below, we use tildes (~) to denote quantities which are known to the household, but unknown to the econometrician. We assume $0 < \tilde{p}^- \leq p \leq \tilde{p}^+$ and posit that the range $[\tilde{p}^-, \tilde{p}^+]$ may be narrower or wider, depending on the agroclimatic conditions faced by the household and the cropping system it chooses. The latter will in turn depend on the endowments of the household and its agronomic environment. For a given level of transaction costs, the price band $[\tilde{p}^-, \tilde{p}^+]$ may slide up or down along the real line depending on how forces of supply and demand impact p, the observed market price.

When a non-trivial price band $[\tilde{p}^-, \tilde{p}^+]$, $\tilde{p}^+ - \tilde{p}^- > 0$ exists for one or more factors, market prices are no longer sufficient in determining the optimal input mix. In this case both the household-specific costs of transacting, and the household specific-shadow price $\tilde{s}$ of the factor figure in the household's decision. Depending on where its shadow price falls relative to the price band, a household may become a (net) seller, a non-participant, or a (net) buyer.

Let $(a_d, a_h) \in \mathcal{A}\times\mathcal{A}$ denote the adjustment regime of the household where the set $\mathcal{A} = \{-,+,0\}$ denotes the alternatives available to the household. That is, a_j (j = d for land, j = h for labor) takes on a value in the set $\mathcal{A}$ depending on whether the household adjusts the jth margin downwards (–), upwards (+), or not at all (0). The characterization of the possible factor adjustment regimes in terms of the relationship between shadow prices, and effective sales and purchase prices are given in Table 3.[14]

According to our formulation, a household which is constrained from entering the sellers or buyers side of the market faces an infinite price in that market. In the extreme situation when sales or purchase markets are missing, all households face an infinite price in that market. Note that unlike models which focus on commodity or factor-specific market failure (see, for example, Strauss, 1986), the present formulation views the problem as being household-specific. As better infrastructure, more efficient methods of monitoring, and mechanisms for information acquisition become available, some or all of the costs of transaction can be driven to zero. The market functions smoothly -- in the manner depicted by the standard supply-demand model -- when $\tilde{p}^- = p = \tilde{p}^+$. In this *frictionless* setting the same market price p determines the actions of all households.

4. AN ECONOMETRIC MODEL OF SIMULTANEOUS FACTOR ADJUSTMENTS

The key to our formulation is that markets for contracting land and labor exist, but are selectively utilized. If the shadow price of a factor falls inside a non-trivial price band that emerges due to transaction costs, there is no incentive to trade that factor. To operationalize our theoretical model, we turn to a latent variable formulation. We first express the latent effective purchase and sales prices of the factors as linear functions of observed variables (captured by the vector $\underline{x}$) plus a household-specific random disturbance (captured by v):

$$(1) \qquad \tilde{p}_j^- = \alpha_{0j} + \underline{\alpha}_j'\underline{x} + v_j, \quad j=d,h;$$

$$(2) \qquad \tilde{p}_j^+ = \beta_{0j} + \underline{\beta}_j'\underline{x} + v_j, \quad j=d,h.$$

[14] Subscripts were chosen so that j = d denotes *dönüm*, the unit of land area commonly used in Turkey, and j = h denotes hours of labor.

We assume that the same household-specific random disturbance impacts both the effective sales and the purchase price.[15] Next, we express the latent shadow prices of the factors as linear functions of $\underline{x}$, plus a random disturbance w_j which captures the unobserved factors unique to the household:[16]

$$\tilde{s}_j = \gamma_{0j} + \underline{\gamma}_j'\underline{x} + w_j, \quad j=d,h. \tag{3}$$

In anticipation of the identification issues which are discussed below, we define the reduced form parameters (π's) in terms of the common structural parameters (α's, β's and γ's) as

$$\begin{aligned} \pi^-_{0j} &= \alpha_{0j} - \gamma_{0j}, \\ \pi^+_{0j} &= \beta_{0j} - \gamma_{0j}, \\ \underline{\pi}^-_j &= \underline{\alpha}_j - \underline{\gamma}_j, \\ \underline{\pi}^+_j &= \underline{\beta}_j - \underline{\gamma}_j, \quad j=d,h. \end{aligned} \tag{4}$$

There are two reduced form parameters associated with each covariate. These measure the excess of that covariate's influence on the effective market price, over its influence on the shadow price, respectively for the sale (π^-_j) and purchase (π^+_j) side of the transaction.

Letting $u_j \equiv w_j - v_j$, the adjustment regimes can be expressed in terms of the thresholds that u_j's must cross, as shown in Table 4. Our objective is to estimate the reduced form parameters which determine the household-specific thresholds. Towards that end, we assume that the pair of random disturbances u_d, u_h are distributed independently of $\underline{x}$ as standard bivariate normal with correlation coefficient ρ. Letting $g(\cdot,\cdot;\cdot)$ denote the bivariate standard normal density and defining the parameter vectors $\underline{\vartheta}_j = (\pi^-_{0j}, \pi^+_{0j}, \underline{\pi}^{-\prime}_j, \underline{\pi}^{+\prime}_j)'$ for $j = d$ and h, the likelihood function may be expressed as

$$L(\underline{\vartheta}_d,\underline{\vartheta}_h,\rho) = \prod_{(a_d,a_h)\in\mathcal{A}\times\mathcal{A}} \int_{\mathcal{R}(a_d)} \int_{\mathcal{R}(a_h)} g(u_d,u_h;\rho)\, du_h du_d \tag{5}$$

where Π denotes the product operator and the ranges of integration $\mathcal{R}(a_j)$ are given in Table 4.

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[15] If distinct random disturbance terms are allowed in (1) and (2), estimation is no longer feasible. Our assumption confines integration to two dimensions -- rather than the four called for by the unrestricted model. Our actual point of departure was a slightly more general model: in place of (1) we had

$$\tilde{p}^-_j = \alpha_{0j} + \underline{\alpha}_j'\underline{x} + \delta v_j, \quad j=d,h. \tag{1'}$$

This allows unobserved heterogeneity to have a different impact on the sale and purchase sides of the market. Since our estimation procedure cannot identify δ, we set it equal to 1 and left it out of equation (1).

[16] Our specification is in line with the usual treatment of shadow prices, which are obtained by linearizing a concave budget constraint. See Moffitt (1990).

The likelihood function is recognized as an unrestricted bivariate ordered probit model, in which the thresholds are allowed to be linear functions of the explanatory variables. The conventional ordered probit model imposes the testable restriction $\underline{\pi}_j^- = \underline{\pi}_j^+$. It can be shown that the reduced form parameters $\underline{\vartheta}_d$, $\underline{\vartheta}_h$ and ρ are identified when all the cells of the 3×3 table have entries, which is the case in our empirical work.[17] Inspection of the relationships given in (4) reveals that the structural parameters cannot be identified without additional assumptions. Providing any one of the α's, β's or γ's equal zero for a given element of the covariate vector, the remaining two are identified.[18]

5. THE MAIN HYPOTHESES:

Our latent variable formulation enables us to test several hypotheses which shed light on theoretical debates concerning agriculture. Three of these deserve special mention, because they illustrate what can be achieved by our methodology.

Hypothesis 1: *(Market Failure) Market imperfections induce significant differences between the sales and purchase prices of factors and selectively exclude households from participation.*

We follow de Janvry *et al.* (1991) and interpret the existence of a non-trivial price band as evidence of market failure. From equations (1), (2) and (4) we find

$$(6) \qquad \begin{aligned} \bar{p}_j^+ - \bar{p}_j^- &= \beta_{0j} - \alpha_{0j} + (\underline{\beta}_j - \underline{\alpha}_j)'\underline{x} \\ &= \pi_{0j}^+ - \pi_{0j}^- + (\underline{\pi}_j^+ - \underline{\pi}_j^-)'\underline{x}. \end{aligned}$$

A non-trivial price band exists (in market j) if and only if $\bar{p}_j^+ - \bar{p}_j^- > 0$. If market failure is not a selective phenomenon -- in the sense that specific conditions faced by a household do not determine participation status -- the width

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[17] Sufficiency can be shown as follows: consider a model without covariates. In that case five parameters have to be estimated, four constants and a correlation coefficient. The joint frequency distribution provides eight independent sources of information (the ninth is determined by the adding up restriction). Five parameters are easily retrievable from eight equations. When covariates are introduced, we have an additional condition similar to that in least squares regression: identification of the covariate effects requires that the data matrix be of full column rank.

[18] The distinction we have drawn between the structural and reduced form parameters of our model requires clarification. When non-tradable inputs are present, it is well-known that the separability between the production and consumption decisions of the household is lost. In this case input demands become functions of the household's endowments and shadow prices, as well as market prices. The shadow prices, in turn, become functions of the endowments and market prices (Strauss, 1986; Seavey, 1987; de Janvry *et al.*, 1991). Equations (1)-(3) are an intermediate step between the decision rule of the household, and the estimating equations, where we substituted for the endogenous variables on the right hand side and collected like terms. It should be clear that what we term "structural" parameters are not preference or technology parameters of the household. They serve as a convenient device for emphasizing the identification problems, which are manifestations of non-separability.

of the price band will be the same across households. A necessary and sufficient condition for homogeneity of the price band $[(\underline{\beta}_j - \underline{\alpha}_j)'\underline{x} = \underline{0}$ for all $\underline{x}]$ is $\underline{\pi}^+_j = \underline{\pi}^-_j$, which we term the *homogeneity* restriction.[19]

In a frictionless market $\bar{p}^+_j = \bar{p}^-_j$ would hold. The sufficient conditions are $\underline{\pi}^+_j = \underline{\pi}^-_j$ *and* $\pi^+_{0j} = \pi^-_{0j}$, which restore symmetry of the sales and purchase markets. We refer to this extreme form of homogeneity as the *symmetry* restriction. In view of (4) neither form of homogeneity imposes any restrictions on the parameters of the shadow price equation.

If the homogeneity restriction is rejected, the reasons behind market failure can be identified by focusing on the individual elements of the covariate vector. For example, it is possible to test the hypothesis put forward by de Janvry *et al.* (1991) that commercialization of agriculture (as captured by regional measures) decreases the likelihood of market failure (that is, the price band shrinks). If markets fail, household endowments of land and labor should figure in the decision to hire labor, and the decision to lease in land. Furthermore, when markets fail the logic of factor adjustment suggests that demand for land (labor) will be a decreasing function of the labor (land) endowment. Tests of these implications will shed further light on the appropriateness of our formulation.

Hypothesis 2: *(Interdependence) Adjustments that take place on the land and labor margins are interdependent.*

In our statistical model, adjustments on the labor and land margins are related through the correlation coefficient ρ. We therefore interpret evidence against the null hypothesis $\rho = 0$ as evidence in favor of interdependence. Recall that $\rho = \text{cov}(u_d, u_h)$. Decomposition yields

$$(7) \qquad \rho = \text{cov}(w_d, w_h) + \text{cov}(v_d, v_h) - \text{cov}(w_d, v_h) - \text{cov}(v_d, w_h).$$

It is not possible to sign ρ unless additional assumptions are made. In our empirical work we explore this issue further by experimenting with the covariate specifications in (1)-(3).

Hypothesis 3: *(Prohibitive Transaction Costs) Households which fail to adjust input margins are excluded from markets by prohibitively high transaction costs.*

Recall our transaction costs justification for divergence of effective sales and purchase prices. Using (7) it is possible to estimate the size of the price band, hence the magnitude of the transaction costs, faced by each household. If households fail to adjust the factor margins because they face prohibitive transaction costs, then those who do not adjust should collectively face significantly higher costs.[20] Allowing for heterogenity, we pursue this line of

[19] Note that the homogeneity restriction is built into the conventional specification of the ordered probit model. Our formulation provides an economic interpretation of the conventional restriction.

[20] To be exact households in the (0,0) cell should have the highest total transaction costs, those who adjust both margins should have the lowest, and those who adjust only one margin should fall somewhere in between. Since we are unable

thinking on the respective margins (i) by testing the null hypothesis that the ordering of average predicted transaction costs by adjustment regime is as posited, and (ii) by testing the null hypothesis that between-regime variations in predicted transaction costs exceed within-regime variations. Evidence in favor of (i), but against (ii) would suggest that the *comparative advantages* that individual households have (as captured by the random disturbances), rather than differences in the magnitudes of the transaction costs, determine who adjusts and who does not.

6. THE DATA AND THE EMPIRICAL SETTING:

Our empirical work is based on a subsample of agricultural households extracted from the "Male Survey" portion of the "1973 Survey of Structure of Population and Population Problems" conducted by the Hacettepe Institute of Population Studies (HIPS) in Ankara, Turkey. The survey and the agricultural setting are described in detail in Tunalı (1993).

According to HIPS data, 88 percent of agricultural households own land. Of these 1015 (81 percent) self-cultivate. HIPS data provide detailed information on transactions involving land (see Figure 1 in Tunalı, 1993). By comparison, information on the labor margin is rather limited. We classified households that hired either permanent wage laborers or casual workers on a regular basis as adjusting their labor pool upwards. Households that had at least one member who worked off the farm on a regular basis were classified as adjusting their labor endowment downwards. In the full sample of self-cultivating households shown in Table 1, two simultaneously leased land in and out, and 33 simultaneously hired labor in and out.[21] These were excluded from our analysis. Since the theoretical debates which motivated our paper pertain to the family farm, we chose to exclude six households who owned land in excess of 500 *dönüm*(125 acres).

Further exclusions were called for because of data constraints.[22] In our econometric work we therefore focus on a working sample of 754 owner-cultivators. The adjustment regimes chosen by these households are presented in Table 5. Observe that the cell proportions are almost identical to those we encountered in the full sample. Based on a Chi-square test, the null hypothesis that the

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to identify variances (see note 15) we cannot conduct the joint test.

[21] It is well-known that members of agricultural households engage in temporary migrations to work off the farm during lean periods (see Tunalı, 1995). The same household might hire in casual labor during periods of peak agricultural activity. In the case of land, the household might lease out distant or otherwise unsuitable parcels of land and lease in elsewhere, to concentrate its activities in one area or one crop. Households which engage in simultaneous transactions can be classified by constructing a net adjustment measure. Unfortunately the information in our data set does not allow us to quantify the adjustments on the labor margin.

[22] Our method of constructing the household size variables (described in note 26 below) required that 194 observations be dropped. Additional 26 observations were dropped because of missing or inconsistent information on the covariates. While all the geographic regions are represented in our working sample, statistical examination revealed that a larger percentage of households in regions other than the Central one were excluded. Implications of this are discussed below.

adjustments to the land and labor margins are independent (in the working sample) was handily rejected.[23]

In the South Asian context factors such as property rights, labor laws, and the caste system have been identified as important determinants of observed patterns of tenancy and labor use (see Otsuka *et al.*, 1990, pp.2003-5). In Turkey there are no legal restrictions on tenancy or the form it takes, nor on labor mobility, written or otherwise (Aksoy, 1984). While some remnants of feudalism persisted in the southeastern provinces at the time of the 1973 HIPS Survey, these were not included in the sampling frame (Tunali, 1993). These observations suggest that there is a good match between our empirical context, and the theory we are testing.[24]

Comparison with census data reveals that our working sample represents above average activity on the land and labor margins.[25] Since our objective is to test hypotheses concerning rare events, overrepresentation of market participants is a welcome situation. However, the fact that we may not have a random sample of family farms in Turkey calls for a cautious interpretation of the findings for policy purposes.

The list of explanatory variables we relied on in operationalizing our latent variable formulation is given in Table 6, alongside the summary statistics. The average landowning male household head in our sample owns 46.6 *dönüm* (about 12 acres), is 47 years old, has more than two years of formal schooling, and has

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[23] The value of the test statistic is 12.16. A Chi-square variate with 4 degrees of freedom exceeds this value with probability 0.016.

[24] Comparison with other studies which addressed a similar set of issues suggests that our data set, although somewhat dated, has the advantages of near-national coverage and moderately large sample size. We use data on 754 households drawn from 62 of Turkey's 67 provinces in 1973. Pant (1983) used ICRISAT data from six villages collected in 1975-76 and 1976-77. Sample size is not provided. Nabi (1985) used data from 4 villages in Pakistan, collected in 1976-77. Sample sizes are 194, 179, 73 and 114. Seavey (1987) used data from 256 villages, 17 states of India, collected in 1970-71, yielding a sample of size of 2862 (for the examination of land leasing and labor hiring decisions). Bell and Sussangkarn (1988) used data on 362 households from Thanjavur district in South India, collected in the early 1970s. Pereira and Sumner (1990) used ICRISAT data from six villages, over two years (which are not identified), and reported a sample size of 351. Shaban (1993) used ICRISAT data from 3 villages, collected over 1975-84, with reported sample sizes of 353, 351, and 394. Skoufias (1994, 1995) also relied on ICRISAT data, obtained from 179 households in 6 villages, over the period 1975-84.

[25] According to the 1970 General Census of Agriculture, 86 percent of "small" agricultural households in Turkey -- whose operation sizes are comparable to those in our sample -- do not participate in short-term transactions involving land. Less than one percent of all self-cultivating households lease land out; evidently almost all landowning households that lease land out do not self-cultivate. Turning to the labor margin, census data reveal that 84 percent of cultivating households engage their labor entirely on the family farm. Data on the breakdown of the labor force by ownership status of land indicate that only about ten percent of the households' labor pool -- consisting of members aged 12 years or older -- works either permanently or occasionally on others' holdings.

spent the last 22 years at the 1973 location of residence. The labor endowment of the average household consists of 3.6 adults, and one teenage child.[26]

The data used in this study were collected after two decades of commercialization, namely increases in the use of agricultural machinery and fertilizer use, improvements in infrastructure and transportation equipment, and increases in the availability of farm credit at subsidized rates. However, not all regions were equally affected. That agroclimatic factors played an important role in influencing historical settlement patterns and the development of commercial agriculture in Turkey is well-documented (see Pamuk and Toprak, 1988; Keyder, 1989). We therefore relied on several variables to keep track of differences in the agronomic environment. The first seven variables shown under this heading in Table 6 were compiled from publications of the State Institute of Statistics. Our rainfall variable measures the amount of rain recorded during the growing season (November to June) in the province in which the household resided. The next six covariates provide district level information. The first variable in this group records the proportion of villages in the district of residence which can rely on irrigation. The second and third variables respectively record activity in agricultural labor markets. The remaining three characterize cultivation practices. Information on quality of land, and region of residence came from the HIPS Survey.

7. ESTIMATION RESULTS:

Having taken the position that the characteristics of the household and the agronomic environment it operates in, determine the factor adjustment regime, we need to account for these determinants in our empirical work. Towards that end we experimented with a long list of conditioning variables implied by theory, and employed in the empirical literature. In what follows, we concentrate on a baseline model which we believe captures the essentials. The covariate vector of the baseline model consists of the first six household characteristics and the first seven agronomic environment variables listed in Table 6. We subsequently describe the specification checks we performed with the help of the remaining covariates. While the main results turned out to be robust to our sensitivity analyses, the findings from the latter shed light on secondary issues suppressed in the baseline model.

Tests of the main hypotheses:

We begin by summarizing what we learned from the baseline model with the aid of the statistics collected in Table 7. These pertain to the first step in our estimation procedure, which involved the maximization of (5). Based on the

[26] The data extract we worked with does not provide information on the demographic composition of the household. We therefore relied on conjectures about household composition to construct our household size variables, based on information on the age of the male respondent, his marital status, and the number of surviving children by sex. According to demographic data obtained from components of the 1973 HIPS Survey which were not available to us, average age at marriage for women was 18, and fertility after age 45 was negligible (Toros, 1978). Since husbands typically are a few years older, we inferred that male household heads who are younger than 30 years old would only have very young children, and those between 30 and 40 years of age would have teenage children. By the same logic, children of older household heads (age > 40) are likely to be adults. Because girls marry off and leave the family farm, we excluded them from the count of adults.

likelihood ratio test, the baseline model with 13 covariates fits the data extremely well (p-value < 10^{-23}). It also turns out to be the model of choice according to AIC. Of the models nested by the baseline model, both AIC and the likelihood ratio criterion favor model 3 over model 4. That is, the six household characteristics do a better job of classifying households according to the factor adjustment regime than the seven agronomic environment variables. Based on the likelihood ratio test, the homogeneity restriction (model 5) is handily rejected (p-value < 1.6×10^{-5}). Thus the aggregate evidence overwhelmingly sides with the Market Failure hypothesis.

Turning to the Interdependence hypothesis, we first focus on the model without covariates (model 2). We find that our parametric specification also rejects independence, corroborating the findings from the Chi-square tests. The null that ρ is zero is rejected in favor of the alternative that it is negative (p-value = .017). Observe that model 4 yields the same result. The correlation is driven to zero when household characteristics are included (see models 1 and 3). This pattern indicates that interdependence is induced by the household characteristics. The fact that the residual correlation is driven to zero in the baseline model suggests that our specification not only captures land and labor endowments in a satisfactory fashion, but it also accounts for variations in farming experience. Further, it implies that in the Turkish context it is safe to study the tenancy market independently of the market for agricultural labor, and vice versa, providing factor endowments of the household are properly accounted for.

Having found strong evidence of market failure, we turn to our third main hypothesis next and ask whether nonparticipant households are excluded from markets because of prohibitive transaction costs. To answer this question, we substitute the estimates of the threshold parameters obtained in the first step in (6) and obtain the Maximum Likelihood estimates of the household-specific transaction costs. Of the 2×754 costs predicted by our model, none were negative; this suggests that there are no outliers in our sample.

Average values of the transaction costs predicted from the baseline model and their within-cell standard deviations are reported in Table 8. When we examined the patterns on the individual margins, average transaction costs indeed turned out to be significantly lower for households which adjusted one or more margins. Note, however, that within-cell variations are quite large. In fact ANOVA revealed that adjustment regime explains less than 6 percent of the variation in transaction costs.[27] In light of the sizes of the within-cell variations, we reject hypothesis 3 and conclude that transaction costs are not prohibitive: participation status is determined on the basis of the comparative advantages that a household has in responding to the conditions it faces. As we show below, both regional factors and household characteristics play a role in establishing the

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[27] ANOVA results were as follows:

$$\underset{}{\text{PTCLAND}} = \underset{(0.033)}{2.94} - \underset{(0.15)}{0.64}\ \text{OUT} - \underset{(0.068)}{0.26}\ \text{IN}, \quad R^2 = 0.039;$$

$$\underset{}{\text{PTCLABOR}} = \underset{(0.019)}{1.95} - \underset{(0.043)}{0.23}\ \text{OUT} - \underset{(0.035)}{0.18}\ \text{IN}, \quad R^2 = 0.054.$$

Here PTCLAND and PCTLABOR denote the predicted transaction costs from equation (6), OUT takes on the value 1 if the household adjusts down, 0 otherwise, and IN takes on the value 1 if the household adjusts up, 0 otherwise.

edge needed for surmounting the costs of transacting.

Can the empirical evidence amassed so far be reconciled with a different view of factor markets than the one we have adopted? We believe not. In fact, we already ruled out three explanations found in the literature in section 2. Nevertheless we find it useful to entertain two other alternatives which emerged during our deliberations.

The first of these is motivated by a conjecture about agricultural technology. What if markets function about as well as they can be expected to function, but because of indivisibilities households which are close to their efficient input mix do not find it worthwhile to adjust?[28] When we examine the amounts traded in land transactions we find that 5 percent of the owner-cultivators who adjust their land holding downwards lease out 1 *dönüm* or less; 10 percent lease out 2 *dönüm* or less; 25 percent lease out 3 *dönüm* or less. Of those who increase their holding size, 5 percent lease in 2 *dönüm* or less; 10 percent lease in 4 *dönüm* or less; 25 percent lease in 6 *dönüm* or less. The fact that small parcels of land change hands for the duration of the growing season suggests that land is not a lumpy factor. Put differently, fixed costs of contracting do not appear to bar farmers from land markets. This is a significant finding, because it suggests that the type of costs that matter are those which have to do with opportunistic behavior (in the form of effort witholding, misreporting of costs or output, and asset mismanagement), the very factors which render contracts incomplete.

The second alternative explanation is based on a conjecture about household preferences. What if nonparticipating agricultural households simply have a taste for working on their own land, with their own resources? Clearly preferences may influence shadow prices and play a role in determining the adjustment patterns. However, if the premise that preferences are much less likely to impact effective prices is accepted, our transaction cost interpretation is on solid grounds. This follows from the fact that shadow prices cancel out in equation (6).

In the remainder of this section we elaborate on the theme of transaction cost induced market failure by focusing on individual variables.

Estimates of the threshold parameters:

The Maximum Likelihood estimates of the threshold parameters of the baseline model are presented in Table 9. Variables which have positive coefficients increase the thresholds on the sales side (π_d and π_h) thereby increasing the likelihood of entering the sales market. They also push the thresholds on the purchase side (π_d^+ and π_h^+) up and decrease the likelihood of entering the purchase market. Negative coefficients imply the opposite effects. It is worth pointing out that all the covariates included in the baseline model, except for the number of young children, are statistically different from zero (at the ten percent level of significance or better in two tail tests) in one or more columns.

Observe that in the case of household characteristics, $\text{sign}(\pi_d) = -\text{sign}(\pi_h)$ and $\text{sign}(\pi_d^+) = -\text{sign}(\pi_h^+)$. That is, if a given household characteristic (read endowment) increases an adjustment threshold on one margin, it decreases the

[28] Strictly speaking this scenario is not in conflict with a transaction costs explanation, but it hints that presence of indivisibilities cannot be taken as evidence that markets fail.

corresponding adjustment threshold on the other. This pattern is easily reconciled with a factor ratio adjustment motive: households with high land/labor ratios (relative to the optimum) enter the factor markets to lower this ratio, while those with low land/labor ratios have the opposite objective.

These observations have important implications about the manner in which markets function. Consider land markets first. We find that households are more likely to be sellers than buyers as their land endowment increases, and more likely to be buyers than sellers as their adult labor pool increases (p-values < .05). These results are in agreement with the findings reported by Bliss and Stern (1982), Pant (1983), Nabi (1985), Seavey (1987), Bell and Sussangkarn (1988), Kochar (1992), Shaban (1993) and Skoufias (1995). Turning to labor markets, we find the reverse is true: households are more likely to be buyers than sellers as their land endowment increases, and more likely to be sellers than buyers as their adult labor pool increases (p-values < .05). Seavey (1987) reports the same pattern. When markets exist and function properly, "... the number of workers in Baron Rothschild's vineyards should not depend on the number of daughters he has," as Benjamin (1992, p.288) put it. Thus our finding that land and labor endowments of the household have a bearing on who participates in markets lends further credence to our conclusion that markets fail.[29]

Estimates of transaction costs:

The tight link between our theoretical and econometric models allows us to go beyond reduced form correlations in drawing inferences about the reasons behind market failure. This is facilitated by the Maximum Likelihood estimates of the price band parameters reported in Table 10. In view of (6), variables that have positive coefficients in Table 10 widen the price wedge and hinder participation; those with negative coefficients reduce transaction costs and render adjustments more likely. Note that variables which do not have a significant effect on the width of the price band can still influence adjustment patterns. When they do, they push both the effective sales and the effective purchase price in the same direction, leaving the width of the price band unchanged. We therefore switch between Tables 9 and 10 as necessary.

Starting with the agronomic environment variables, we find that cultivation practices have important implications for market participation. Some of these have a straightforward interpretation: for example, in areas where vineyards-orchards are found in larger concentration, incentive problems associated with short-term use of perennials dampen activity on the land margin (p-value = .017). Others are less obvious, especially when we invoke a commercialization interpretation. According to de Janvry *et al.* (1991), commercialization of agriculture facilitated by better infrastructure (such as improved transportation and irrigation facilities, wider availability of credit), better technology (such as improved seed varieties and fertilizers) will bring about a reduction in the size of the price band and thus increase participation in factor markets. This

[29] Benjamin (1992), Jacoby (1993) and Skoufias (1994) rely on measures of the demographic composition of the household for tests of departures from properly functioning labor market models. A crucial assumption in this undertaking is that the demographic composition of the household is exogenous. For example, if Baron Rotschild hires workers because he does not have sons, the exogeneity assumption would be violated. The independence between the long- and short-run adjustment regimes shown in section 2 vindicates our use of endowments as legitimate conditioning variables.

scenario applies to changes that take place over time. Keeping in mind that different regions of Turkey were at different junctures in the process of agrarian transformation in 1973, what can we say about the link between commercialization and participation in factor markets?

Consider the case of water supplies: areas where rainfall and irrigation facilities can be depended upon typically favor commercialized agriculture. Increases in productivity (often realized through multiple cropping) and decreases in yield variation increase the value of land and the scope for entrepreneurship. While the prospect of greater potential damage from abusive use could discourage owners from leasing land, we would at the very least expect to find increased activity on the labor margin. The price band parameters on rainfall and irrigation facilities reported in Table 10 do not support this prediction.

The magnitudes of the estimated threshold parameters reported in Table 9 suggest a possible explanation for this apparent conflict with the commercialization hypothesis. We find that owner-cultivators who can benefit from irrigation facilities are indeed more likely to hire in wage labor. At the same time they are much less likely to hire out family labor: the estimated threshold coefficient on the sales side of the market (p-value = .036) is nearly two-and-a-half times that on the purchase side (p-value < .0001). That family labor becomes much more valuable when engaged on the family farm in areas where land is cultivated intensively lends credence to the view put forward by Datta and Nugent (1989, pp.58-9), who underscore the contractual complications brought about by the increased importance of timing, sequencing and input mix considerations. Effective use of modern inputs requires close supervision, which in turn adds to the costs of transacting.

Where rain-fed grain cultivation is the only feasible farming activity, communities resort to the practice of setting sizable chunks of land aside for fallow in order to preserve soil moisture (Keyder, 1989). This practice is typically associated with relatively backward or traditional agriculture. Yet, our findings indicate that labor markets are more active in these areas. Examination of the threshold coefficient estimates reported in Table 9 reveals that there is increased activity on the sales side of the labor market (p-value = .012), and decreased activity on the sales side of the land market (p-value = .031). Evidently owner-cultivators residing in areas where fallow practice is common shun the sales market for land (because of communal restrictions on cultivated area) and enter the casual labor market (most likely to work for large farms during harvest time).[30]

Strongest support for the commercialization hypothesis comes from our measures of labor market activity. We find that transaction costs are significantly lower for households residing in districts which receive, and send out agricultural labor (p-values < .005). We interpret the increased flow of workers as signs of better transportation and information links between markets. The reported patterns with agronomic environment variables turned out to be robust to changes in the model specification (discussed in some detail below). We conclude, then, that our findings lend guarded support for the commercialization

[30] In her detailed study of agricultural practices in Central Turkey, Bazoğlu-Balamir (1984) points out that labor market activity associated with rain-fed grain cultivation is confined to harvest labor. Since the information in our data set does not allow us to distinguish labor use by task, we were unable to pursue this lead.

hypothesis of de Janvry *et al.* (1991).

Turning to the household characteristics, we find two factors exert statistically and economically significant influence on both margins: schooling of the male household head and the number of adults. Why schooling should reduce transaction costs is easily understood: educated farmers can mitigate information problems and become better monitors/managers of hired and family resources. Our findings indicate that households can substitute quantity for quality and achieve the same result on the labor margin: farms which can count on a larger pool of adult members find it easier to participate in labor markets. The effect of an additional year of formal schooling is a shade below that of an adult, a result which underscores the importance of education.

Checks on the baseline specification:

According to the threshold parameter estimates reported in Table 9, households with a large labor endowment are more likely to lease land in, and less likely to lease land out. The net effect captured in Table 10 however, is increased relience on own land. Why larger households should face higher transaction costs in the land market is not easily understood. Elaborations on the baseline specification revealed nonlinearities, but did not resolve the issue.[31]

Evidence from around the World and Turkey is that small farms use labor more intensively (Sen, 1981; Ministry of Agriculture, 1967). The extra labor is directed at investment activities -- such as land leveling, bunding, improving drainage and roads, and topsoil conservation -- which increase land quality. Could it be that our failure to control for land quality is responsible for the observed pattern? To pursue this logic, we added the land quality indicators listed in Table 6 into the model. We found that better than average land quality increased the likelihood of hiring in labor. Households with poorer than average land were more likely to hire out, and less likely to hire in labor. However the impact of the number of adults on the land margin remained the same. Apart from noting that the evidence in our sample corroborates the pattern of labor intensive cultivation by small landowners, we do not have a transaction costs explanation for our finding.

Why households headed by older males should face higher transaction costs in the labor market is also a puzzle. We pursued this issue by adding years in the village into our baseline model. This wiped out the effect of age, but confronted us with another puzzle: the longer the household resides in a community, the less likely it is to participate in land markets (p-value = .0035). Based on information arguments one would expect the opposite. Could it be that longer residence allows the households to make long-run adjustments? To answer this question, we added the long-run adjustment variables (had migrants, bought or sold land) into the equation. They turned out to be statistically nonsignificant, and increased duration continued to be detrimental to participation.

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[31] We found that households benefit from increases in the number of adult members until they reach an optimal size of 3.3; beyond that participation in land markets becomes increasingly costly. This figure is based on a model in which the baseline model was augmented by including quadratic terms for the amount of land, age of the male head, and number of adults. The joint significance of the quadratic terms could not be established using a likelihood ratio test (p-value = 0.17). The price band parameter for the number of adults was statistically significant (p-value = .063) on the land margin.

Returning to Table 10, we see that the land endowment of the household does not influence the width of the price bands. If we invoke the collateral interpretation of Eswaran and Kotwal (1986), access to credit markets appears to be equal. Accounts given in Bazoglu-Balamir (1984), Pamuk and Toprak (1988), and Keyder (1989) support this interpretation. To pursue the issue of market imperfections further, we included animal wealth and the number of draft animals owned by the household as additional regressors. We envision two different interpretations of the role played by animal wealth: first, viewed as a measure of the household's financial reserves, higher animal wealth should make it easier for the household to circumvent working capital constraints and engage in transactions. Second, seen as an indicator of specialization, higher animal wealth would signal the fact that the household's comparative advantage is not in farming, but in husbandry. Our results suggest that the second interpretation dominates: households with higher animal wealth are less likely to enter land markets as cultivators (p-value = .006).

In light of the moral hazard problems associated with their rental use, the literature views draft animals as non-tradable inputs. As such, they should influence the adjustment regime of the household. Since draft animals are engaged in traditional methods of agriculture, their presence signals lack of commercialization. In line with this interpretation, we find that households which rely on draft animals for cultivation are less likely to enter labor markets (p-value < .05).

For a final check on our specification we relied on the regional dummies identified in Table 6, choosing the grain producing Central region as our reference category. The region dummies turned out to be highly significant, but did not alter the conclusions drawn from the baseline model.[32] Results indicated that land markets in all four regions were more active compared to those in the Central region, and labor markets in the Western region were more active compared to others.

8. CONCLUSION:

Imperfections, in the form of missing or less than smoothly functioning markets, appear to have wide appeal in the literature on backward, even modern agriculture. Recent efforts to operationalize the role of transaction costs -- such as that by de Janvry, Fafchamps and Sadoulet (1991) -- offer an attractive analytical framework for examining the role played by imperfections in generating observed household behavior. Our paper constitutes an attempt to confront this promising line of theoretical research with real world data, in the context of markets for tenancy and agricultural labor. Our model can distinguish between competing views of the manner in which markets function; further, our econometric formulation enables us to test for the presence of market imperfections with rather limited amounts of data.

A striking feature that Turkish agriculture shares with many less developed countries is the overwhelming incidence of owner-cultivation based on family resources. Why households do not adjust their endowments of land and labor, and how difficulties of adjustment on one margin might influence the other margin, are questions we address in this paper. Our findings forcefully show that systematic differences in household characteristics and the agricultural environment they

[32] The likelihood ratio test favored inclusion of the region variables (p-value < .0061). AIC value was 2349, a shade below that of the baseline model.

face, influence the choices of households among various adjustment regimes. Thus, we side with the view that market failure is a household-specific phenomenon, and not a universal condition.

We believe this view offers a much needed synthesis for operationalizing theoretical models of a rational agent in environments characterized by imperfections. As we have shown, efficiency considerations indeed are at the heart of the adjustments that take place in factor markets. However, when costs of transacting impose a sufficiently high burden, exchange does not take place -- owner-cultivators make do with their own resources. Markets reward those households which have an edge in surmounting the costs of transacting by allowing them to reap the benefits of exchange.

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Table 1. Observed short-run and long-run adjustment regimes in the Turkish sample of owner-cultivators‡

Cell counts (percent of total)

	Lease land out (a_d = −)	Do not participate (a_d = 0)	Lease land in (a_d = +)	Lease land in and out	Row totals
Hire labor out (a_h = −)	**2 [0.20]** *0 (0.00)* 0 (0.00)	**100 [9.85]** *13 (11.11)* 14 (13.21)	**38 [3.74]** *3 (2.56)* 2 (1.89)	**0 [0.00]** *0 (0.00)* 0 (0.00)	**140 [13.79]** *16 (13.68)* 16 (15.10)
Do not participate (a_h = 0)	**18 [1.77]** *0 (0.00)* 2 (1.89)	**433 [42.66]** *52 (44.44)* 39 (36.79)	**126 [12.41]** *15 (12.82)* 13 (12.26)	**2 [0.20]** *1 (0.85)* 0 (0.00)	**579 [57.04]** *68 (58.12)* 54 (50.94)
Hire labor in (a_h = +)	**20 [1.97]** *1 (0.85)* 1 (0.94)	**183 [18.03]** *20 (17.09)* 21 (19.81)	**60 [5.91]** *9 (7.69)* 11 (10.38)	**0 [0.00]** *0 (0.00)* 0 (0.00)	**263 [25.91]** *30 (25.64)* 33 (31.13)
Hire labor in and out	**0 [0.00]** *0 (0.00)* 0 (0.00)	**26 [2.56]** *1 (0.85)* 2 (1.89)	**7 [0.70]** *2 (1.71)* 1 (0.94)	**0 [0.00]** *0 (0.00)* 0 (0.00)	**33 [3.26]** *3 (2.56)* 3 (2.83)
Column totals	**40 [3.94]** *1 (0.85)* 3 (2.83)	**742 [73.10]** *86 (73.50)* 76 (71.70)	**231 [22.76]** *29 (24.79)* 27 (25.47)	**2 [0.20]** *1 (0.85)* 0 (0.00)	**1015 [100.00]** *117 (100.00)* 106 (100.00)

‡Source: 1973 Hacettepe Institute of Population Studies (HIPS) Survey.
Bold = all households in cell; *italic* = households with migrants; normal = households which bought or sold land.

Table 2. Conditional short-run adjustment probabilities‡

Labor, given land:

	$(a_d = 0)$	$(a_d \neq 0)$
$P(a_h = 0 \mid a_d)$	0.58	0.53
$P(a_h \neq 0 \mid a_d)$	0.42	0.47

Land, given labor:

	$P(a_d = 0 \mid a_h)$	$P(a_d \neq 0 \mid a_h)$
$(a_h = 0)$	0.75	0.25
$(a_h \neq 0)$	0.71	0.29

‡Calculated using the **bold** figures in Table 1.

Table 3. Possible adjustment regimes and conditions on the prices

Regime (a_d, a_h)	Land margin	Labor margin
(–,–)	$\mathfrak{s}_d \leq \mathfrak{p}_d^-$	$\mathfrak{s}_h \leq \mathfrak{p}_h^-$
(0,–)	$\mathfrak{p}_d^- < \mathfrak{s}_d < \mathfrak{p}_d^+$	$\mathfrak{s}_h \leq \mathfrak{p}_h^-$
(+,–)	$\mathfrak{p}_d^+ \leq \mathfrak{s}_d$	$\mathfrak{s}_h \leq \mathfrak{p}_h^-$
(–,0)	$\mathfrak{s}_d \leq \mathfrak{p}_d^-$	$\mathfrak{p}_h^- < \mathfrak{s}_h < \mathfrak{p}_h^+$
(0,0)	$\mathfrak{p}_d^- < \mathfrak{s}_d < \mathfrak{p}_d^+$	$\mathfrak{p}_h^- < \mathfrak{s}_h < \mathfrak{p}_h^+$
(+,0)	$\mathfrak{p}_d^+ \leq \mathfrak{s}_d$	$\mathfrak{p}_h^- < \mathfrak{s}_h < \mathfrak{p}_h^+$
(–,+)	$\mathfrak{s}_d \leq \mathfrak{p}_d^-$	$\mathfrak{p}_h^+ \leq \mathfrak{s}_h$
(0,+)	$\mathfrak{p}_d^- < \mathfrak{s}_d < \mathfrak{p}_d^+$	$\mathfrak{p}_h^+ \leq \mathfrak{s}_h$
(+,+)	$\mathfrak{p}_d^+ \leq \mathfrak{s}_d$	$\mathfrak{p}_h^+ \leq \mathfrak{s}_h$

Table 4. Reduced form representation of the adjustment regimes

Regime (a_d, a_h)	Land margin bounds $\mathcal{R}(a_d)$	Labor margin bounds $\mathcal{R}(a_h)$
(–,–)	$-\infty \leq u_d \leq \pi^-_{0d} + \underline{\pi}^{-\prime}_{-d}\underline{x}$	$-\infty \leq u_h \leq \pi^-_{0h} + \underline{\pi}^{-\prime}_{-h}\underline{x}$
(0,–)	$\pi^-_{0d} + \underline{\pi}^{-\prime}_{-d}\underline{x} < u_d < \pi^+_{0d} + \underline{\pi}^{+\prime}_{-d}\underline{x}$	$-\infty \leq u_h \leq \pi^-_{0h} + \underline{\pi}^{-\prime}_{-h}\underline{x}$
(+,–)	$\pi^+_{0d} + \underline{\pi}^{+\prime}_{-d}\underline{x} \leq u_d \leq \infty$	$-\infty \leq u_h \leq \pi^-_{0h} + \underline{\pi}^{-\prime}_{-h}\underline{x}$
(–,0)	$-\infty \leq u_d \leq \pi^-_{0d} + \underline{\pi}^{-\prime}_{-d}\underline{x}$	$\pi^-_{0h} + \underline{\pi}^{-\prime}_{-h}\underline{x} < u_h < \pi^+_{0h} + \underline{\pi}^{+\prime}_{-h}\underline{x}$
(0,0)	$\pi^-_{0d} + \underline{\pi}^{-\prime}_{-d}\underline{x} < u_d < \pi^+_{0d} + \underline{\pi}^{+\prime}_{-d}\underline{x}$	$\pi^-_{0h} + \underline{\pi}^{-\prime}_{-h}\underline{x} < u_h < \pi^+_{0h} + \underline{\pi}^{+\prime}_{-h}\underline{x}$
(+,0)	$\pi^+_{0d} + \underline{\pi}^{+\prime}_{-d}\underline{x} \leq u_d \leq \infty$	$\pi^-_{0h} + \underline{\pi}^{-\prime}_{-h}\underline{x} < u_h < \pi^+_{0h} + \underline{\pi}^{+\prime}_{-h}\underline{x}$
(–,+)	$-\infty \leq u_d \leq \pi^-_{0d} + \underline{\pi}^{-\prime}_{-d}\underline{x}$	$\pi^+_{0h} + \underline{\pi}^{+\prime}_{-h}\underline{x} \leq u_h \leq \infty$
(0,+)	$\pi^-_{0d} + \underline{\pi}^{-\prime}_{-d}\underline{x} < u_d < \pi^+_{0d} + \underline{\pi}^{+\prime}_{-d}\underline{x}$	$\pi^+_{0h} + \underline{\pi}^{+\prime}_{-h}\underline{x} \leq u_h \leq \infty$
(+,+)	$\pi^+_{0d} + \underline{\pi}^{+\prime}_{-d}\underline{x} \leq u_d \leq \infty$	$\pi^+_{0h} + \underline{\pi}^{+\prime}_{-h}\underline{x} \leq u_h \leq \infty$

Table 5. Adjustment regimes in the working sample of owner-cultivators‡

Cell counts (percent of total)

	Lease land out (a_d = −)	Do not participate (a_d = 0)	Lease land in (a_d = +)	Row totals
Hire labor out (a_h = −)	2 (0.27) *2 [0.20]*	79 (10.47) *100 [10.21]*	29 (3.85) *38 [3.88]*	110 (14.59) *140 [14.29]*
Do not participate (a_h = 0)	12 (1.59) *18 [1.84]*	331 (43.90) *433 [44.18]*	99 (13.13) *126 [12.86]*	444 (58.62) *577 [58.88]*
Hire labor in (a_h = +)	16 (2.12) *20 [2.04]*	143 (18.97) *183 [18.67]*	43 (5.70) *60 [6.12]*	202 (26.79) *263 [26.84]*
Column totals	30 (3.98) *40 [4.08]*	553 (73.34) *716 [73.06]*	171 (22.68) *224 [22.86]*	754 (100.00) *980 [100.00]*

‡Figures in *italics* give the distribution in the full sample, shown in **bold** in Table 1, after excluding households which engaged in simultaneous transactions on a particular margin.

Table 6. List of explanatory variables and summary statistics

Variable	Definition‡	Mean	St.dev.
Household characteristics:			
Land	Amount of land owned (*dönüm*)	46.6	68.7
Age	Years of age	46.6	12.9
Schooling	Years of formal schooling	2.4	2.81
No. of young children	No. of children × 1(if age less than 30)	.21	.78
No. of teenage children	No. of children × 1(if age between 30 and 40)	1.01	1.96
No. of adults	1 + 1(if married) + no. of boys × 1(if age > 40)	3.56	1.73
Animal wealth	Value of animal stock (1,000 *lira*)	10.2	13.9
No. of draft animals	Total no. of oxen, water buffaloes and horses	.88	1.52
Years in village	Years of residence in 1973 village	21.6	13.6
Had migrants	1(if household size changed because of migration during 1968-73)	.11	.31
Bought or sold land	1(if household bought or sold land during 1963-73)	.11	.31
Agronomic environment:			
Rainfall	Rainfall during growing season in province (cm)	47.2	27.7
Irrigation facilities	Prop. of villages with irrigation facilities	.57	.22
Agricultural labor outmigration	Prop. of villages which send out agricultural workers	.29	.17
Agricultural labor inmigration	Prop. of villages which receive agricultural workers	.17	.15
Fallow practice	Ratio of fallow area to cultivated area	.31	.31
Vineyard-orchard concentration	Ratio of vineyard-orchard area to cultivated area	.51	1.31
Vegetable field concentration	Ratio of vegetable field area to cultivated area	.055	.085
Land of good quality	1(if own land better than average in the area)	.16	.36
Land of poor quality	1(if own land worse than average in the area)	.20	.4
Central region (reference)	1(if household resides in Central region)	.31	.46
Northern region	1(if household resides in Northern region)	.2	.4
Western region	1(if household resides in Western region)	.24	.43
Southern region	1(if household resides in Southern region)	.10	.3
Eastern region	1(if household resides in Eastern region)	.15	.36

‡Individual information pertains to the male household head. Dummy variables equal 1 if the statement inside the parentheses applies to the household, 0 otherwise. Sample size = 754.

Table 7. Summary results from models nested by the baseline model

Model	No. of parameters	Log likelihood	Null vs. baseline χ^2 stat. (d.f.)	AIC	$\hat{\rho}$ (std.er.)
1. Baseline model‡	57	-1118.3	—	2350.6	-.051 (.057)
2. No covariates	5	-1233.4	230.2 (52)	2476.8	-.11 (.052)
3. Household characteristics only†	29	-1164.2	91.8 (28)	2386.4	-.034 (.056)
4. Agricultural environment variables only#	33	-1182.7	128.8 (24)	2431.4	-.12 (.054)
5. Baseline model with homogeneity restriction	31	-1152.0	67.4 (26)	2366.0	-.038 (.05)

‡Combines models 3 and 4.
†Includes the first six household characteristics in Table 6.
#Includes the first seven agronomic environment variables in Table 6.

Table 8. Maximum Likelihood estimates of average transaction costs
Baseline model

(Within-cell standard deviations in parentheses)

	Lease land out (a_d = –)	Do not participate (a_d = 0)	Lease land in (a_d = +)	Labor margin
Hire labor out (a_h = –)	Land: 2.77 (0.67) *Labor: 1.76 (0.34)*	Land: 3.14 (0.92) *Labor: 1.70 (0.36)*	Land: 2.93 (0.78) *Labor: 1.80 (0.42)*	Land: 3.08 (0.87) *Labor: 1.72 (0.37)*
Do not participate (a_h = 0)	Land: 2.43 (0.48) *Labor: 1.74 (0.47)*	Land: 2.95 (0.84) *Labor: 1.94 (0.39)*	Land: 2.65 (0.42) *Labor: 1.99 (0.35)*	Land: 2.87 (0.77) *Labor: 1.95 (0.39)*
Hire labor in (a_h = +)	Land: 2.15 (0.47) *Labor: 1.86 (0.66)*	Land: 2.80 (0.82) *Labor: 1.77 (0.44)*	Land: 2.56 (0.50) *Labor: 1.74 (0.43)*	Land: 2.70 (0.76) *Labor: 1.77 (0.46)*
Land margin	Land: 2.30 (0.48) *Labor: 1.80 (0.56)*	Land: 2.94 (0.85) *Labor: 1.86 (0.41)*	Land: 2.68 (0.53) *Labor: 1.90 (0.40)*	Land: 2.85 (0.79) *Labor: 1.87 (0.42)*

Table 9. Maximum Likelihood estimates of the threshold parameters
Baseline model

(Heteroscedasticity-consistent standard errors in parentheses)

Variable	π_d^-: Land sales	π_d^+: Land purchases	π_h^-: Labor sales	π_h^+: Labor purchases
Constant	−1.58 (.54)	.092 (.38)	−.033 (.46)	1.75 (.40)
Household characteristics:				
Land	.0023 (.001)	.0015 (.00087)	−.0023 (.0013)	−.0039 (.00085)
Age	.014 (.0086)	.019 (.0058)	−.025 (.007)	−.0098 (.0054)
Schooling	.093 (.028)	.042 (.02)	−.063 (.025)	−.12 (.02)
No. of young children	−.33 (.25)	−.0054 (.081)	.013 (.08)	.12 (.077)
No. of teenage children	−.092 (.059)	−.01 (.034)	.028 (.036)	−.073 (.033)
No. of adults	−.18 (.065)	−.071 (.038)	.17 (.04)	.099 (.038)
Agronomic environment:				
Rainfall	−.0099 (.0048)	.005 (.0027)	−.0036 (.0033)	−.002 (.0029)
Irrigation facilities	−.22 (.51)	−.77 (.31)	−1.37 (.36)	−.55 (.31)
Ag. labor outmigration	.46 (.51)	.41 (.31)	.83 (.43)	−.42 (.33)
Ag. labor inmigration	.66 (.81)	.068 (.45)	1.69 (.53)	−.29 (.45)
Fallow practice	−.65 (.35)	−.17 (.19)	.47 (.21)	−.086 (.19)
Vineyard-orchard concentration	−.38 (.21)	.1 (.09)	.058 (.074)	−.0013 (.068)
Vegetable field concentration	2.41 (1.44)	.33 (1.09)	−2.38 (1.02)	−.94 (.95)

Table 10. Maximum Likelihood estimates of the price band parameters
Baseline model

(Heteroscedasticity-consistent standard errors in parentheses)

Variable	$\pi_d^+ - \pi_d^-$: Land		$\pi_h^+ - \pi_h^-$: Labor	
Constant	1.67	(.69)	1.79	(.54)
Household characteristics:				
Land	−.00083	(.0012)	−.0016	(.0014)
Age	.0051	(.0098)	.015	(.0079)
Schooling	−.051	(.033)	−.056	(.029)
No. of young children	.32	(.26)	.11	(.099)
No. of teenage children	.082	(.065)	−.045	(.044)
No. of adults	.11	(.073)	−.069	(.049)
Agronomic environment:				
Rainfall	.015	(.0054)	.0016	(.0039)
Irrigation facilities	−.55	(.58)	.82	(.41)
Ag. labor outmigration	−.051	(.57)	−1.25	(.48)
Ag. labor inmigration	−.59	(.89)	−1.98	(.61)
Fallow practice	.48	(.39)	−.38	(.24)
Vineyard-orchard concentration	.48	(.23)	−.059	(.09)
Vegetable field concentration	−2.08	(1.81)	1.43	(1.29)

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